June 1965

Brief 65-10190

NASA TECH BRIEF

IR-Transmission Glasses Formed from Oxides of Bismuth and Tellurium

The problem: Development of bismuth trioxide (Bi_2O_3)-tellurium dioxide (TeO_2) glasses with improved IR (infrared) transmission characteristics. Although glass compositions in this binary system are expected to have semiconducting characteristics and good IR transmission, little data on this system has been reported in the literature. Presently available IR-transmitting glasses have a cutoff wavelength of only 4.5 microns.

The solution: Glasses formed from melts of Bi_2O_3 and TeO_2 containing from 75% to 90% (by weight) of TeO_2.

How it's done: Mixtures containing different proportions of the chemically pure components were melted in an electric furnace. The melts were then cast in preheated graphite molds and annealed at 250°C.

Samples of the castings were then subjected to X-ray and electron diffraction analysis to identify those which had been converted to glasses. It was found that mixtures containing approximately 75% to 90% TeO_2 had the characteristics of a glass; samples containing other proportions of Bi_2O_3 and TeO_2 were crystallized. All the glasses were opaque to visible light and crystallized at 550°C. Their resistivities were found to lie between those of good insulators and semiconductors.

The electrical resistivities and dielectric constants of two of the glass compositions at different temperatures are listed below.

COMPOSITION TeO_2 (Wt %)	COMPOSITION Bi_2O_3 (Wt %)	TEMPERATURE (°C)	RESISTIVITY (ohm-cm)	DIELECTRIC CONSTANT
75	25	−196	3.6×10^{11}	23.9
		27	3.3×10^{10}	25.8
90	10	−196	2.6×10^{11}	21.7
		27	5.7×10^{10}	26.1
		127	4.7×10^{9}	---

The glass containing 90% TeO_2 had an IR transmission of 80% at 4 microns (upper transmission limit of present glasses), and a cutoff at approximately 7.5 microns.

Note: Inquiries concerning this invention may be directed to:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama, 35812
Reference: B65-10190

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA, Code AGP, Washington, D.C., 20546.

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